AD-A132 439 OPERATING AND SUPPORT COST ESTIMATING GUIDE SAMPLE ANALYSIS NAVY AIRCRAFT AT DSARC I(U) COST ANALYSIS IMPROVEMENT GROUP WASHINGTON D C 01 JAN 80 1/1

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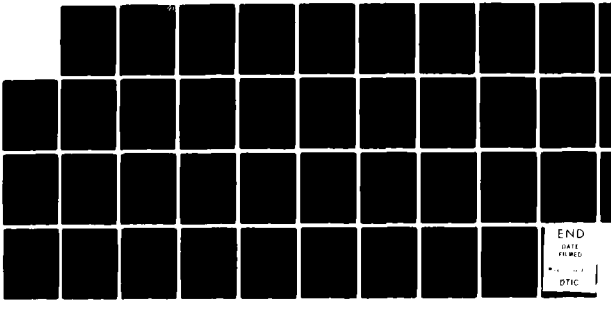

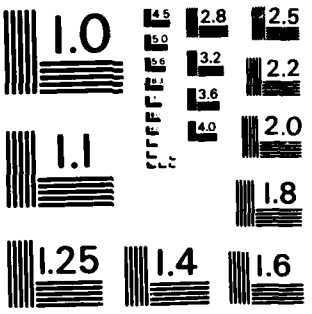

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OPERATING

and

SUPPORT

COST ESTIMATING GUIDE

SAMPLE ANALYSIS
NAVY AIRCRAFT AT DSARC I

* * *

Office of the Secretary of Defense
Cost Analysis Improvement Group

1 January 1980

FORWARD

DOD Directive 5000.4 "OSD Cost Analysis Improvement Group", provided the charter for the Cost Analysis Improvement Group (CAIG) to review and establish criteria, standards, and procedures concerning the preparation and presentation of cost estimates on defense systems to the DSARC and CAIG. In support of this objective, the CAIG has periodically issued guidance for development and presentation of Operating and Support (O&S) cost for OSD review. To date general guidance has been made available for aircraft, ships, and ground combat vehicles.

In consonance with that general guidance, the following sample of a CAIG Operating and Support Cost Estimate Report covering a hypothetical case has been developed to further assist the cost analyst in the preparation of cost estimating reports submitted to the DSARC and CAIG during the acquisition process of a new weapon system.

This sample is not intended to imply the existence of a specific acquisition program. Nor does it imply a preference for one analysis technique over another. The sample is intended to show an example of how Operating and Support Costs can be developed for CAIG review with available data bases and one example of an appropriate format for presentation of cost estimates.

The existing A-7E data base was used only to illustrate the need to relate an estimate to an existing similiar system and to ensure a constant relationship between values and the Cost Element Structure. It is not used to promulgate the use of specific data bases. Each case should address that data which is the most complete and accurate for its purposes. Further, the level of detail depicted in this example may be greater than that which is available or appropriate to a specific case.

The sample is designed to complement the Cost Analysis Improvement Group's Aircraft Cost Development Guide. Jointly, these two documents can provide the basis for program manager developing a cost estimate that is acceptable for CAIG review.

EXECUTIVE SUMMARY

Operating and Support (O&S) costs for the F/A-X and the current A-7E system (baseline) are shown below:

	A-7E	F/A-X
$/Acft/yr	$ .8M	$ 1.0M
$/Sqdn/yr	$ 9.9M	$ 11.7M
15 yr Force O&S	$1,661.0M	$1,959.8M

Squadron costs are based on a 12 PAA squadron operating at 372 flying hours per PAA per year. The force O&S costs are based on a five year delivery schedule plus ten years of full force operations of 168 PAA.

Although the F/A-X represents a dramatic increase in performance, O&S costs will increase by only 20% over the A-7E. This is due to . . .

GUIDANCE: THE EXECUTIVE SUMMARY IS A SIMPLE ONE PAGE NARRATIVE PROVIDING THE BOTTOM LINE COSTS, FORCE SIZE AND MAJOR COSTS DRIVERS, AND ASSUMPTIONS. INCLUDE A BRIEF EXPLANATION OF DIFFERENCES PREDICTED FROM THE BASELINE SYSTEM.

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1. INTRODUCTION

The following cost analysis report is submitted in support of Defense Systems Acquisition Review Council (DSARC) Milestone I review of the F/A-X Program . . . . All values included in this report are in FY80 dollars unless indicated otherwise.

GUIDANCE: IDENTIFY THE MILESTONE MISSION ELEMENT NEEDS STATEMENT (MENS) AND DECISION COORDINATING PAPER (DCP) WITH DATE AND THE BASE YEAR FOR COSTS IN THE INTRODUCTION.

The existing fleet of A-6As and A-7Es were designed in the 1950s and 1960s, and although they have proven to be capable aircraft, their designs will be over thirty years old in the 1990s. Their on board weapons delivery systems and self defense/warning systems render them . . . .

GUIDANCE: INCLUDE A SHORT STATEMENT SUMMARIZING THE MENS/DCP AND ANY SIGNIFICANT DEVIATIONS THAT THE COST ANALYSIS MAKES FROM THE DOCUMENTS.

The objective of this program is to provide an attack aircraft capable of performing strike and close air support to ground operations as well as being able to survive in the combat air environment of the 1990s and beyond.

The system is in the concept development state. Three contractors are developing paper designs to meet the required characteristics identified in Section 2. This analysis is based on a generic design incorporating . . . .

GUIDANCE: ALSO, OUTLINE THE PROGRAM, ITS STAGE OF DEVELOPMENT, MAJOR SYSTEM PARAMETERS, AND MAJOR POTENTIAL RISKS THAT IMPACT OPERATING AND SUPPORT (O&S) COSTS.

Table 1 presents the Operating and Support (O&S) costs for the baseline (A-7E) and the generic systems. The data is shown for a squadron of 12 aircraft operating for one year. Tables 2A through ( ) present the O&S costs for the recommended alternative by fiscal year for a 15 year life cycle. It is based on the mature squadron O&S costs and assumes that aircraft delivered in a given year are costed at half their annual O&S rate.

GUIDANCE: INCLUDE A MATRIX OF O&S ANNUAL COSTS FOR TYPICAL DEPLOYABLE UNIT(S) IN THE COST ELEMENT STRUCTURE (CES) ARRIVED AT THROUGH CONSULTATION WITH THE COST ANALYSIS IMPROVEMENT GROUP (CAIG). SEPARATE COLUMNS WILL BE ESTABLISHED FOR

EACH ALTERNATE SYSTEM. THESE COSTS SHOULD ALSO BE PRESENTED BY FISCAL YEAR WITH A SEPARATE TABLE FOR EACH ALTERNATIVE SYSTEM.

TABLE 1. ANNUAL OPERATING AND SUPPORT COSTS
(THOUSANDS, FY80$)

1 SQUADRON, 12 PAA, 372 FH/PAA/YR

Cost Element	A-7E		F/A-X	
Unit Mission Personnel		$3542		$2564
Air Crew	513		486	
Maintenance	2415		1557	
Other	614		521	
Unit Level Consumption		$2309		$1956
POL	1392		2944	
Maintenance Material	676		784	
Training Ordnance	241		228	
Depot Level Maintenance		[illegible]		$3947
Airframe Rework	575	[illegible]	443	
Engine Rework	1112	[illegible]	2224	
Component Repair	62[illegible]	[illegible]	621	
Support Equipment	[illegible]	[illegible]	11	
Software	[illegible]	[illegible]	-	
Modifications	-	[illegible]	-	
Other Depot	542	[illegible]	748	
Contract Unit Level Support	-	[illegible]	-	
Sustaining Investment		$[illegible]		$736
Reparable Spares	148		220	
Replacement Support Equip.	175		264	
Modification Kits	252		252	
Other Recurring Investment	-		-	
Installation Support Personnel		$148		$105
Base Operating Support	140		99	
Real Property Management	-		-	
Medical	8		6	
Indirect Personnel Support		$296		$209
Misc Operations & Maint.	-		-	
Medical O&M Non-Pay	115		82	
Permanent Change of Station	154		108	
Temporary Additional Duty Pay	27		19	
Depot Non-Maintenance		$ 80		$109
General Depot Support	80		109	
Second Dest Transportation	-		-	
Personnel Acquisition & Training		$102		$ 73
Acquisition	12		9	
Individual Training	90		64	
TOTAL		$9913		$11699

TABLE 2.A F/A-X FORCE OPERATING AND SUPPORT COSTS (MILLIONS, FY80$) FISCAL YEAR BREAKOUT

	Fiscal Year									
	86	87	88	89	90	91	92-01	02	03	TOTAL
Number of Operating Squadrons	1	2	5	7	9	11	13	6	3	
Deliveries	12	12	36	36	36	36	91	-	-	259
Unit Mission Personnel	1.3	3.8	9.0	15.4	20.5	25.6	[illegible]	15.4	7.7	[illegible]
Installation Support Personnel	.1	.2	.4	.6	.8	[illegible]	[illegible]	.6	[illegible]	17.6
*Subtotal (MILPERS)	1.4	4.0	9.4	16.0	21.[illegible]	26.7	[illegible].3	16.0	8.0	447.1
Unit Level Consumption	[illegible]	5.9	13.8	23.[illegible]	[illegible].6	39.6	[illegible]0.3	[illegible].7	11.9	662.5
Depot Level Maintenance	[illegible]	5.9	13.8	[illegible]	31.6	39.5	[illegible]	23.7	11.8	661.2
Indirect Personnel Support	.1	.3	[illegible]	1.3	1.7	2.1	27.0	1.3	.6	35.1
Depot Non-Maintenance	.1	[illegible]	.4	.7	.9	1.1	14.1	.7	.3	18.4
Personnel Acquisition & Training	[illegible]	.1	.3	.4	.6	.7	9.4	.4	.2	12.1
*Subtotal (O&M)	4.2	12.4	29.0	49.8	66.4	83.0	1070.0	49.8	24.8	1389.4
Sustaining Investment	.4	1.1	2.6	4.4	5.9	7.4	94.9	4.4	2.2	123.3
*Subtotal (PROCUREMENT)	.4	1.1	2.6	4.4	5.9	7.4	94.9	4.4	2.2	123.3
*GRAND TOTAL	6.0	17.5	41.0	70.2	93.6	117.1	1509.2	70.2	35.0	1959.8

** Delivery schedule is based on WSPD on F/A-X, date: _____.

GUIDANCE: *NOTE: FIGURES ARE ALSO INCLUDED IN ANNEX B OF THE INTEGRATED PROGRAM SUMMARY.

2. ASSUMPTIONS AND GROUND RULES

2.1 General.

Prior experience has demonstrated that economic benefits can be obtained from increasing design for equipment modularity . . . . F/A-X is intended to design to reduce the number of WRA/SRAs by about 50% from the A-7E level of technology. This will be accomplished by use of plug-in circuit boards or circuit chips . . . . Subsequent trade off analyses will establish the cost effectiveness and practicality of detail design concepts . . . .

GUIDANCE: INCLUDE A GENERAL DESCRIPTION OF SYSTEM CHANGES AND DISCUSS THEIR ANTICIPATED IMPACTS ON O&S COSTS INDICATING THE DEGREE OF CONFIDENCE THAT THE CHANGES ARE PRACTICAL AND COST IMPACTS ARE ACCURATE.

2.2 Baseline System.

For this analysis the A-7E weapon system was selected as the reference system. The A-7E is the main weapon system to be replaced. Its operating environment is similar, and there is a substantial and accurate data base covering its operating costs . . . .

GUIDANCE: IDENTIFY THE BASELINE SYSTEM AND EXPLAIN THE RATIONALE USED IN ITS SELECTION.

2.3 System and Program Characteristics.

Table 3 illustrates aircraft and program characteristics of the alternatives . . . .

GUIDANCE: INCLUDE DETAILS OF EACH ALTERNATIVE SYSTEM.

TABLE 3. SYSTEM CHARACTERISTICS ADVANCED F/A-X

(Preliminary)

Mission: Fighter/Attack with Recon Secondary

Range: 600-700 NM radius - Fighter/Recon: over 500 NM radius-Attack (with auxiliary tanks)

Payload: All conventional fighter and attack weapons with an excess of 6000 lbs total combat load. All airborne, special weapons of appropriate weight.

Speed: Over Mach 1.5 at 40,000 ft.

Carrier Suitability: Suitable for operations from large or small carriers with or without catapult assist.

Operational Life: 1988-2008

Assumed Crew: 1

Assumed Squadron PAA: 12 acft

Deployments: (Listed in assumed assignment priority other than Research and Development (R&D)

1 FRS Sqdn (12PAA)- West Coast
2 Fleet Sqdn (12PAA)- Pacific
2 Fleet Sqdn (12PAA)- Atlantic
0* FRS Sqdn (12PAA)- West Coast
2 Fleet Sqdn (12PAA)- Pacific
2 Fleet Sqdn (12PAA)- Atlantic
2 Fleet Sqdn (12PAA)- Pacific
2 Fleet Sqdn (12PAA)- Atlantic

Total Operational Aircraft - 168

* 12 acft added to the West Coast FRS to increase PAA to 24

Flying Program: 31 hr per acft per mo.

2.4 Assumptions, Model Inputs, And Rates.

2.4.1 Design Sensitive Values. Table 4A lists the elements that are design-related . . . .

TABLE 4 A. DESIGN SENSITIVE VALUES

Element	Value	Source	OPR	Ext
1. Empty Weight	18,000 lbs	PM Projection	John Doe	73124
2. Mean Flt Hours between Failures	1.90 hours	PM Projection	John Doe	73124
3. Fuel Consumption	1319 gal/hr	CER (See App. B)		
4. Unit Production Costs	$10M	PM Projection	Jim Smith	75124
5. Portion of Flyaway Cost for Material	51%	Contractor Estimate	Jim Smith	75124
6. Design Impact on Reliability	Structures-78% Avionics - 63%	Fighter/Attack Acft study	John Brown	75124

2.4.1.1 Empty Weight. In order to maintain thrust to weight ratio the design must . . . .

2.4.1.2 Reliability. See paragraph 3.2.2.1, this report.

2.4.1.3 Fuel Consumption. See appendix B.

2.4.1.4 . . . .

GUIDANCE: DIVIDE VALUES USED IN THE COST ESTIMATING MODEL OR ALGORITHMS INTO TABLES DEPENDING ON THE NATURE OF THE PARAMETER INVOLVED. TABLE 4A CONTAINS ELEMENTS WHICH ARE INHERENT TO THE SYSTEM DESIGN AND ARE DEPENDENT ON HARDWARE CONFIGURATION. FOLLOWING THIS TABLE IS A BRIEF EXPLANATION OF THE DERIVATION OF THE VALUE SELECTED FOR THE PARAMETER.

2.4.2 System Operational Standards.

Table 4B identifies the values used in this analysis which reflect current Navy policy . . . .

TABLE 4 B. SYSTEM OPERATIONAL STANDARDS

Element	Value	Source	OPR	Ext
1. Utilization Rate	31.0 hr/mo	PM Projection	John Doe	73124
2. Acft per Sqdn	12 acft	PM Projection	John Doe	73124
3. Attrition Rate	4.5%/acft/yr	OP-512	John Doaks	77111
4. Pipeline Rate	13.5% ops acft	OPNAVINST 3110.11K	Joe Doaks	77111
5. SDLM Interval	84 mo	OP-508	Jack Smith	78192
6. Portion of Flyaway Costs for Support Equipment Repair	0.218%	PM Projection	John Doe	73124
7. Portion of Support Equipment Repair for Condemnation	4.2%	PM Projection	John Doe	73124
8. Crew Ratio	1.5	PM Projection	John Doe	73124

2.4.2.1 Utilization Rate. The F/A-X will require about the same flying hours as the A-7E to support the training . . . . The use of flight simulation will . . . .

2.4.2.2 Aircraft per squadron. The Air Wing Composition Study (adopted as CNO policy) established Navy VF units at 12PAA per squadron . . . .

2.4.2.3 Attrition Rate.

2.4.2.8 Crew Ratio. The F/A-X will be an all weather day/night aircraft. In order to support this multi-role weapon system, it will require a higher crew ratio . . . .

GUIDANCE: LIST THOSE FACTORS ESTABLISHED BY THE USING COMMAND WHICH IMPACT O&S COSTS IN A TABLE. A BRIEF EXPLANATION AND DERIVATION OF THE VALUE SHOWN FOLLOWS THE TABLES.

2.4.3 Standard Values and Rates. Table 4C lists the standard values and rates used and the source . . . .

TABLE 4.C. STANDARD VALUES AND RATES

Element	Value	Source	OPR	Ext
1. POL Costs	$0.50/Gal	OPNAV-51C1	Mary Doe	51234
2. Officer Annual Billet Costs	$27,000	ASD (COMP) Memo	-	-
3. Enlisted Annual Billet Costs	$11,500	ASD (COMP) Memo	-	-
4. Acft Service Life	15 years	ASD (COMP)		
5. Escalation Factors	variable	ASD (COMP)	-	-

GUIDANCE: HIGHLIGHT THOSE STANDARD VALUES WHICH ARE ESTABLISHED AND GENERALLY ACCEPTED IN A TABLE. THESE VALUES ARE NOT SUBJECT TO INFLUENCE BY THE SYSTEM UNDER CONSIDERATION OR THE USING COMMAND.

3. METHODOLOGY

For this analysis the Navy O&S cost estimating model was used.

A summary of this model is provided in Appendix E . . . .

GUIDANCE: IF A GENERALLY APPLICABLE COMPUTERIZED COST ESTIMATING MODEL IS USED FOR THE ANALYSIS INSTEAD OF THE SERIES OF ALGORITHMS LISTED IN APPENDIX D OF THIS REPORT, INCLUDE SUMMARY OF THE MODEL USED, AS WELL AS APPROPRIATE COMPUTER PRODUCTS, IN APPENDIX E OF THE REPORT AND OMIT APPENDIX D.

3.1 Data Sources.

The sources used in defining the baseline costs and the method used in estimating the proposed system's cost are listed in Table 5 for each of the cost elements . . . .

GUIDANCE: INCLUDE A MATRIX OF SOURCES AND METHODS IN THE REPORT.

TABLE 5. DATA SOURCES AND METHODLOGY

Cost Element	A-7E SYSTEM Source	A-7E SYSTEM Method Existing Data:	F/A-X SYSTEM Source	F/A-X SYSTEM Method
UNIT MISSION PERS	OPNAV 10-P35:ASD (COMP) MEMO Jan 30, 1979	Normalized to a Sq/Yr	Manpower Analysis: ASD (COMP) Memorandum, Jan 30,1979	See Appendix A
UNIT LEVEL CONSUMPTION				
POL	NAVAIR INST C10340.26	Normalized to a Sq/Yr	CER See Appendix	Parametrics Normalized to a Cost/sqdn
Maint Material	VAMOSC-AIR MS Rpt	Normalized to a Cost/ FH	Baseline	Scaled by material costs and DMMH/FH
Trng Ordnance	VAMOSC-AIR TSS Rpt	Normalized to a Cost/ FH	Baseline	Scaled by number of crews in sqdn
DEPOT LEVEL MAINT				
Airframe Rework	VAMOSC-AIR TSS Rpt	Normalized to a Sq/Yr	CER See Appendix C	Parametric scaled by SDLM interval
Engine Rework	OPNAV-90P-02B	Normalized to a Sq/Yr	Baseline	Scaled by reliability of engines & installation subsystems
Component Repair	VAMOSC-AIR MS Rpt	Normalized to a sub-system Cost/FH	Baseline	Scaled by material costs, reliability, and design impact
Support Equipment	Program Manager		Program Manager	
Software	N/A		N/A	
Modifications	See Modification Kits		See Modifications Kits	
Other Depot	VAMOSC-AIR TSS Rpt	Normalized to a Cost/ FH	Baseline	Scaled by depot Airframe Engine and component repair
Contracted Unit Level Spt	N/A		N/A	
SUSTAINING INVESTMENT				
Repairable Spares	VAMOSC-AIR MS Rpt	Normalized to a sub-system Cost/FH	Baseline	Scaled by Material cost, reliability, and design impact of each subsystem
Replacement Spt Equip	Program Manager	Normalized to a Cost/ acft	Baseline	Scaled by flyaway costs
Modification Kits	VAMOSC-AIR TSS Rpt	Normalized to a cost/ FH	Baseline	Baseline figures used
Other Recurring Inv	N/A		N/A	
INSTALLATION SPT PERS				
Base Op Spt	OPNAV-90P-02B	Normalized to a Sq/Yr	Baseline	Scaled by total sqdn population
Real Prop Mgmt	See Base Op Spt		See Base Op Spt	
Medical	OPNAV-90P-02B	Normalized to a Sq/Yr	Baseline	Scaled by total sqdn population
INDIRECT PERS SPT				
Misc Op & Maint	Not Available		Not Available	
Medical O&M (Non-Pay)	OPNAV-90P-02B	Normalized to a Cost/ acft	Baseline	Scaled by total sqdn population
PCS	OPNAV-90P-02B	Normalized to a Cost/ acft	Baseline	Scaled by total sqdn population
Temp Add Duty Pay	VAMOSC-AIR TSS Rpt	Normalized to a Cost/ acft	Baseline	Scaled by sqdn enlisted population
DEPOT NON-MAINT				
General Depot Spt	VAMOSC-AIR TSS Rpt	Normalized to a Cost/ FH	Baseline	Scaled by total depot costs
Second Dest Trans	Not Available		Not Available	
PERS. ACQUISITION & TRNG				
Acquisition	OPNAV-90P-02B	Normalized to a Cost/ acft	Baseline	Scaled by total sqdn population
Individual Trng	OPNAV-90P-02B	Normalized to a Cost/ afct	Baseline	Scaled by total sqdn population

3.2 Derivation of Scalars.

In applying the baseline data to the F/A-X and projecting costs it was necessary to establish a proportional relationship between the two systems. These proportions are explain in the following paragraphs . . . .

GUIDANCE: ESTABLISH SOME PROPORTIONAL RELATIONSHIP BETWEEN THE BASELINE SYSTEM AND THE ALTERNATIVES WHEN COST ANALYSIS DATA IS NOT DIRECTLY AVAILABLE FROM THE WEAPON SYSTEM UNDER CONSIDERATION. THIS RELATIONSHIP IS THEN USED TO SCALE THE BASELINE COSTS TO DETERMINE THE ESTIMATED COSTS OF THE ALTERNATIVE SYSTEMS.

3.2.1 Subsystem Selection. Based on the known details of the alternative system, it was determined that the weapons system could be divided into eight somewhat homogenous subsystems . . . .

GUIDANCE: DATA FOR THE BASELINE SYSTEM IS USUALLY AVAILABLE TO THE FIVE DIGIT WORK UNIT CODE BREAKOUT, HOWEVER, IN ORDER FOR THE DATA BASE TO BE COMPATIBLE WITH THE LEVEL OF DETAIL KNOWN OF THE ALTERNATIVE SYSTEM, CONSOLIDATE THE BASELINE DATA AND PROPOSED SYSTEM DATA TO A COMPARABLE LEVEL OF DETAIL. IN THE EXAMPLE, THE PROPOSED SYSTEM WAS DIVIDED INTO EIGHT SUBSYSTEMS AND THE BASELINE DATA CONSOLIDATED ACCORDINGLY.

3.2.2 Reliability. The work unit codes (WUC) for the baseline system were consolidated into eight subsystems which are compatible with the level of detail known about the alternative systems . . . . The alternative system reliability estimates are based on . . . . These figures are reflected in Table 6 . . . .

3.2.2.1 Alternative System Reliability Analysis.

3.2.2.1.1 Structural Element - 7.5.

Estimated improvements over existing like and similar equipment are based on the assumption that the design will make greater use of composite materials and technological advances.

3.2.2.1.2 Power Plant & Installation - 12.8.

Engines will probably be off-the-shelf, slightly modified to increase speed energy efficiency and reliability . . . .

3.2.2.1.3 Fuel System, Hydraulic, Pneumatic - 19.5.

Estimate reflects the expected advantages over the baseline system from the changes to fly-by-wire technology and other technological improvements . . . .

3.2.2.14 Electrical & Wiring - 20.5.

Increase in reliability relative to the baseline system is based on integrating the electronics, embedding the wiring, and improved technology . . . .

3.2.2.1.5 Miscellaneous - 35.0.

Estimate is based on improved reliability of the Air Conditioning and Pressurization systems over the baseline aircraft due to improved technology . . . .

3.2.2.1.6 Instruments - 20.0.

Totally integrated electronics with alternate path circuits and digital readouts is expected to result in large increases in reliability in the instrument package and integrated guidance of the baseline system . . . .

3.2.2.1.7 Comm, Nav, Ident - 25.0.

The estimate is based on expected improvements to the baseline system in UHF command navigation systems by use of alternate path circuitry . . . .

TABLE 6. MEAN TIME BETWEEN FAILURE SUMMARY

WUC Title	A-7E MTBF	F/A-X MTBF
Structural Element	5.283	7.5
11 Airframe	14.0	
12 Fuselage	38.3	
13 Landing Gear	10.9	
Power Plant & Installation	25.564	12.8
23 Engines	61.8	
29 Power Plant Installation	43.6	
Fuel, Hydraulic, Pneumatic	12.747	19.5
14 Flight Controls	27.8	
45 Hydraulic/Pneumatic	45.4	
46 Fuels System	48.9	
Electrical & Wiring	11.424	20.5
42 Electrical System	23.1	
44 Lighting Systems	22.6	
Miscellaneous	26.780	35.0
41 Air Conditioning/Pres	51.	
47 Oxygen Systems	138.	
49 Misc Utilities	15[illegible]1	
91 Emergency Equipment	[illegible].0	
96 Personal Equipment	3[illegible]13.5	
97 Explosive Devices	3337.6	
Instruments	9.340	20.0
51 Instruments	16.7	
56 Flight Reference	365.4	
57 Integrated Guidance	22.5	
Comm, Nav, Ident	8.502	25.0
63 UHF Comm	20.5	
64 Interphone	610.5	
65 IFF	84.8	
66 Emergency Radio	8344.	
67 CNI Integrated Pk	333.8	
69 Misc Comm Equipment	---	
71 Radio Nav	28.2	
72 Radar Nav	59.4	
Offensive/Defensive	4.731	10.5
73 Bomb Nav	6.9	
74 Weapons Control	57.5	
75 Weapons Delivery	35.0	
76 ECM	51.0	
77 Photo Recon	1173.4	
Total System	1.15	1.90

3.2.3 Material Cost Scalar. The material cost scalar of the F/A-X system is 2. Derivation follows . . . .

a. A-7E Procurement: (In Millions)

Year	Costs			Qty	Unit Flyaway Cost
	Actual	Escalation Rates	FY80$		(FY80$)
1970	73.4	2.30	168.8	27	6.25
1971	76.5	2.17	166.0	30	5.54
. . .	. . .	. . .	. . .	. . .	. . .
1977	222.3	1.22	271.2	30	9.04
1978	238.0	1.13	268.9	30	8.96
			Average Unit Flyaway Costs = $6.71		

b. Labor portion of flyaway costs is not scaled.

c. Material Costs

(1) A-7E = 38% of flyaway costs
= .38 x 6.71 = $2.55M

Percentage is based on contractor documentation, available from: list Project Officer, office symbol, extension.

(2) F/A-X = $10M = Flyaway Costs (assumed)

The increase in flyaway costs is due to historical cost trends, increased performance requirements, use of advanced technology, and increase in the percentage of overhead due to lower production rates.

Material Costs = 51% of flyaway
= .51 x 10. = $5.1M

The increase in percentage of flyaway costs is based on the use of expensive composite material in the air frame and the use of micro-electronics.

d. Material Cost Scalar.

= F/A-X System Mat ÷ A-7E Mat

= $5.1 ÷ 2.55

= 2

GUIDANCE: MANY OF THE ALTERNATIVE SYSTEM O&S COSTS WHICH CANNOT BE OBTAINED DIRECTLY MAY BE ESTIMATED BY DETERMINING THEIR RELATIONSHIP TO THE TOTAL COSTS OF THE BASELINE SYSTEM. REPLENISHMENT SPARES AND COMPONENT REPAIR ARE BUT TWO EXAMPLES OF SUCH COSTS. THEREFORE, IT IS OFTEN HELPFUL TO ESTABLISH A RELATIONSHIP BETWEEN THE BASELINE COST AND THE ESTIMATE OF THE ALTERNATIVE SYSTEM'S FACTORS COSTS.

3.2.4 Design/Environment Impact. Based on a study of maintenance actions covering fighter/attack aircraft, subject: . . . dated . . ., it was found that 78% of the structural failures could have been avoided by redesign . . . as such, the assumption is made that . . . is the applicable factors . . . .

GUIDANCE: WHEN APPLYING ESTIMATING FACTORS TO A GIVEN COST, THAT COST CAN SOMETIMES BE SEPARATED INTO TWO PARTS: THOSE WHICH ARE RELATED TO THE DESIGN OF THE COMPONENT IN QUESTION AND THOSE WHICH ARE CONSTANT. INDUCED FAILURES, FALSE REMOVALS, STORAGE AND HANDLING LOSSES ARE EXAMPLES OF CONSTANT COSTS WHICH ARE NOT DIRECTLY DESIGN-RELATED AND SHOULD NOT BE FACTORED INTO THE COST ESTIMATE.

3.2.5 Support Equipment. A review of support equipment purchased in support of fighter/attack aircraft indicates that on an average, .218% of flyaway costs is required for annual equipment replenishment and 4.2% of replenishment costs is expended for depot repair. The anticipated design and maintenance concept changes are expected to shift the emphasis from Organization (O) level to Intermediate (I) level, however these changes should be offsetting. Therefore, the proportions were assumed not to change for this analysis.

GUIDANCE: MAKE AVAILABLE IN THE PENTAGON STUDIES WHICH SUPPORT THE ASSUMPTIONS OF THIS TYPE, BUT WHICH ARE NOT PART OF THE REPORT.

4. SENSITIVITY/RISK ANALYSIS

Although the alternative system(s) lacks a great deal of definition, the method of scaling from the well-established baseline provides a credible basis for the estimations. The uncertainty associated with the Petroleum, Oils, and Lubricants (POL) costs will be relevant regardless of the operational system considered and, therefore, has little bearing on the comparison. The Cost Estimating Relationship (CER) used in estimating POL consumption is . . . .

GUIDANCE: INCLUDE AN INDICATION OF THE CONFIDENCE IN THE FIGURES PRESENTED.

Table 7 reflects four of the most costly parameters and their effects on the total O&S costs: Flyaway Costs; Petroleum, Oils, and Lubricants; Reliability; and Maintainability. Figure 1 presents this data graphically.

GUIDANCE: DEVELOP A FURTHER, DETAILED ANALYSIS OF THE COST IMPACT OF EACH COST ELEMENT OFFERING A POTENTIAL FOR HIGH COSTS, ESPECIALLY THOSE OF WHICH THE VALUE ESTIMATED FOR THE O&S COST ANALYSIS COULD VARY WIDELY, IDENTIFY THE RANGE OF VALUES SELECTED FOR SENSITIVITY ANALYSIS AND THE RATIONALE FOR SELECTION. PRESENT THE RESULTS USING IDENTICAL GRAPHICAL VALUES WHENEVER POSSIBLE TO FACILITATE A COMPARISON.

4.1 Production Material Cost.

Although the Production Material costs used in the O&S cost analysis are based on the best infcrmation available, the potential for cost overruns is typically . . . high. Therefore, the range of values selected . . . .

4.2 POL Costs

Due to the large impact of POL costs and the wide variation in the forecasted price escalation, POL costs are discussed in Appendix B of this report. The range of unit cost values selected for sensitivity . . . .

GUIDANCE: DISCUSS A COST PARAMETER WHICH COULD CONSTITUTE OVER 25% OF THE TOTAL O&S COSTS IN BOTH THE BASIC ANALYSIS AND A SEPARATE APPENDIX. IN THE APPENDIX FOCUS ON THE ISSUES INVOLVED .

4.3 Reliability.

The range of reliability values was based on a review of the potential of each subsystem . . . .

4.4 Maintainability.

The direct maintenance man hours per flying hour (DMMH/FH) was divided into scheduled Organizational level, unscheduled Organizational level and Intermediate level and factored accordingly. It is felt that . . . .

TABLE 7. COST SENSITIVITY/RISK ANALYSIS
(Annual Cost Delta in Thousands)

Table 7.1 PRODUCTION MATERIAL COSTS SENSITIVITY

	Low	Expected	High
		SCALAR	
Flyaway Costs	$8.5M	$10.0M	$12.5M
51% of Flyaway Cost	4.3M	5.1M	6.6M
Scalar	1.7	2.0	2.6
		COST DELTA	
Maint Material	-$78.2	-	+$156.4
Component Rework	- 54.1	-	+ 61.0
Spt Equip Repair	- 1.6	-	+ 2.7
Other Depot	- 31.4	-	+ 51.6
Reparable Spares	- 33.0	-	+ 66.0
Replacement Support Equipment	- 1.8	-	+ 65.0
General Depot Spt	- .4	-	+ .8
Total	-240.5	-	+ 403.5
% of O&S Costs	- 2.1%	-	+ 2.5%

Table 7.2 POL SENSITIVITY

	Low	Expected	High
		COST DELTA	
Cost Per Gal	0.485	0.50	1.00
Total POL Costs	- 88.3	-	+2944.0
% of O&S	- 0.8%		+ 25.2%

	Low	Expected	High
Table 7.3. RELIABILITY SENSITIVY			
	RELIABILITY		
Structural	8.3	7.5	6.4
Power Plant & Instal	15.9	12.8	12.8
Fuel, Hydraulic, Pneu	21.5	19.5	16.2
Elec & Wiring	22.6	20.5	16.0
Misc	38.5	35.0	30.9
Instruments	22.0	20.0	15.0
Comm, Nav, Ident	27.5	25.0	16.8
Offensive/Defensive System	11.6	10.5	7.6
	2.14	1.90	1.54
	COST DELTA		
Maint Material	- 50.2	-	+ 91.4
Component Rework	- 47.3	-	+ 74.9
Other Depot	- 11.0	-	+ 17.6
Reparable Spares	- 15.8	-	+ 27.5
General Depot Spt	1.2	-	+ 2.7
Total	-126.0	-	+214.1
% Variance of	- 1.0%	-	+ 1.8%
Table 7.4. DMMH/FH			
Scheduled O Level	4.4	4.9	5.4
Unscheduled O Level	11.1	12.3	15.6
I Level	5.4	5.4	7.7
Total	20.9	22.6	28.7
	COST DELTAS		
Scheduled O Level	- 9.1	-	9.1
Unschedule O Level	- 21.4	-	58.9
I Level	0	-	83.7
Pre-Expensed	- 8.8	-	31.6
Personal Spt	0	-	0
Total	- 39.3	-	+183.3
% of O&S	- 0.3%	-	+ 1.6%

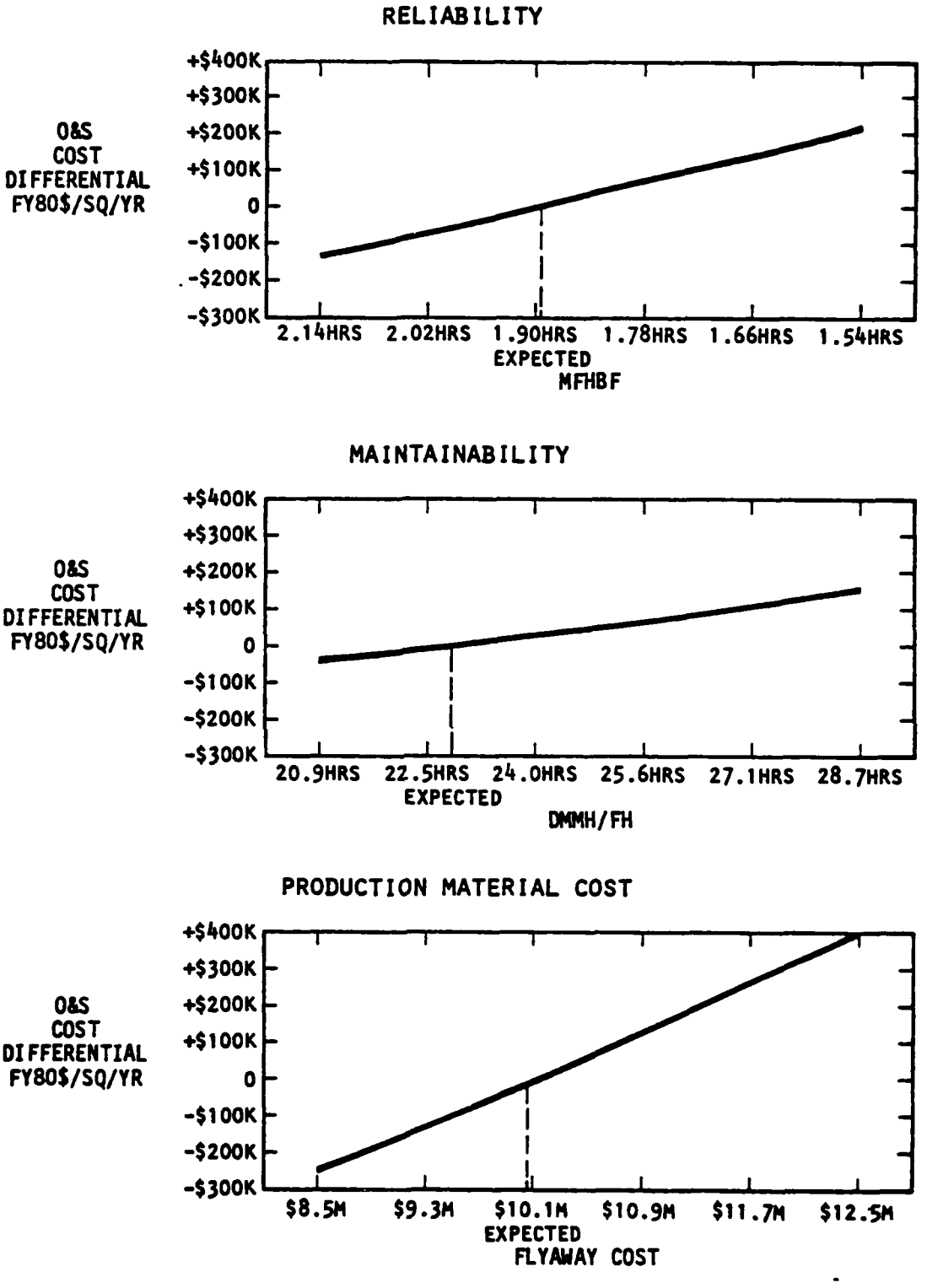

Figure 1. SENSITIVITY/RISK GRAPH

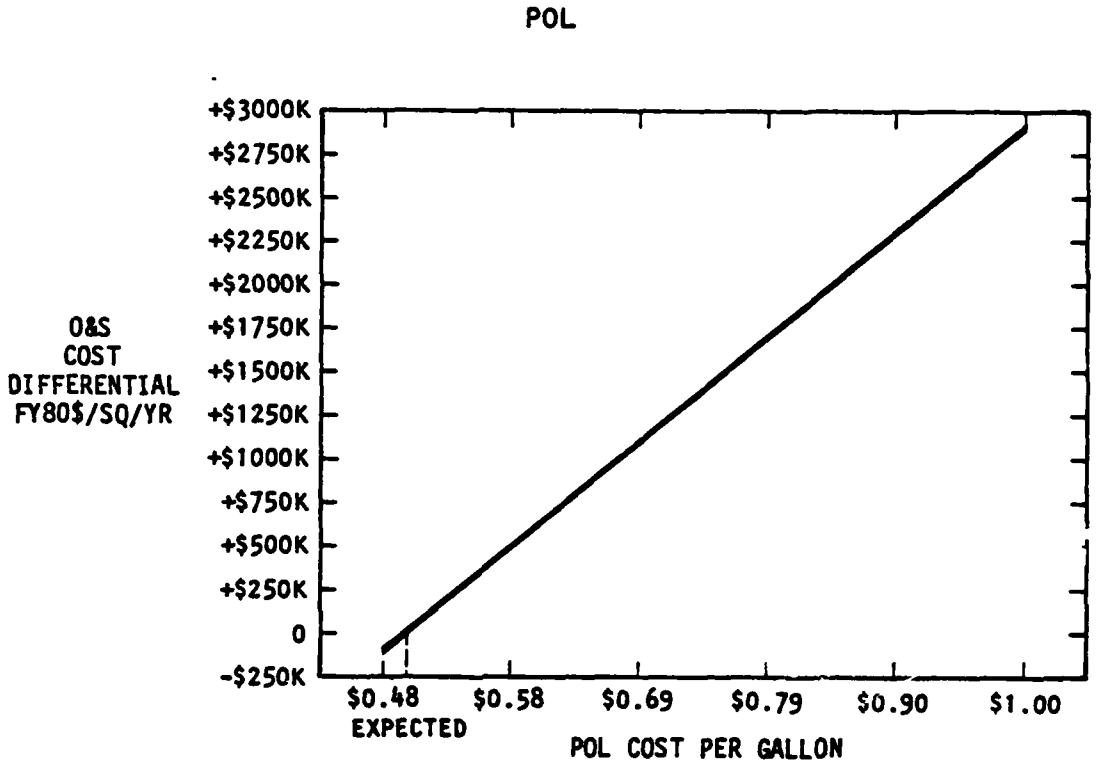

Figure 1 (continued). SENSITIVITY/RISK GRAPH

5. SUMMARY

Still to be resolved are the methods of determining and prorating Miscellaneous Operations and Maintenance and Second Destination Transportation Costs. It is anticipated that these issues will be resolved . . . .

GUIDANCE: NOTE ISSUES LEFT UNRESOLVED OR THOSE WHICH WILL RECEIVE CLOSE SCRUTINY IN THE FUTURE.

As the system develops and more details become known, it is expected that two major directions for refining the estimating techniques will be used: first, the WUC subdivision will be broken out further for more bottoms-up costing, and second, less reliance on scaling will be evident . . . .

GUIDANCE: IDENTIFY ANTICIPATED REFINEMENTS AND NEW APPROACHES TO THE COST ESTIMATING TECHNIQUES.

APPENDIX A. UNIT MISSION PERSONNEL

Table A.1 provides a summary of A-7E and F/A-X unit mission personnel . . . .

A.1 Crew Members.

The F/A-X will be a single seat aircraft. It is planned to have 18 aircrews to a 12UE squadron. The probable use of integrated avionics and automatic features of the alternative systems will tend to improve fatigue tolerance of this aircraft.

Further, a design that focuses on greater flexibility and quicker turnaround time will allow for increased aircraft and crew utilization. It is expected that this will equate to a slight decrease in the crew ratio to aircraft sortie under combat conditions . . . .

GUIDANCE: EXPLAIN THE RATIONALE BEHIND MANNING CHANGES TO THE BASELINE SYSTEM. WHEN THE ALTERNATIVE SYSTEM INCORPORATES NEW CONCEPTS OR A RADICAL DEPARTURE FROM EXISTING SYSTEMS/METHODS, EXPLAIN IN DETAIL THE CHANGE AND ITS EXPECTED IMPACT ON MANNING.

A.2 Maintenance.

A.2.1 Overview. Trends indicate that advanced system ILS planning will include . . . .

GUIDANCE: INCLUDE A DETAILED NARRATION OF FACTORS THAT IMPINGE ON MAINTENANCE MANNING AS A WHOLE, SUCH AS CAPACITY OF FACILITIES, THROWAWAY VS. REPAIR IMPACT, AND MAINTENANCE CONCEPT.

A.2.2 Organizational Maintenance. A 13% decrease in overall supervision is a reflection of the general trend to decrease maintenance manning . . . .

The expected 34% decrease in maintenance technicians at the Organizational level could be due to the use of composite materials, embedded wiring, and integrated electronics with alternate path circuitry. These changes should be expected to . . . .

A.2.3 Intermediate Maintenance. The manpower requirements for Intermediate maintenance reflect a shift in expected workloads. While the workloads in airframe and electrical repair should decrease, avionics complexity should be expected to increase. The need for a more complex test equipment package will . . . .

The anticipated use of socket-mounted components, throwaway circuit boards, and automatic test equipment has been shown to facilitate the fault finding actions and repair time . . . .

A.3 Integrated Services. The accordance with standard Navy methodology manning of this function is calculated as 15% of the other squadron members to be supported. The nine positions are a reflection of the overall reduction in squadron manning . . . .

GUIDANCE: INCLUDE REASONS FOR EACH CHANGE IN MANNING TO THE LEVEL OF DETAIL KNOWN.

Table A.1. UNIT MISSION PERSONNEL
(Preliminary)

	Based on 12 UE					
	A-7E		Changes		F/A-X	
Total Aircrews	19		-1		18	
Total Officers (Off)	23		-3		20	
Total Enlisted (Enl)	254		-78		176	
Total Civilian	0		0		0	
					Manning	
	Off	Enl	Off	Enl	Off	Enl
Squadron						
Exec	2	7			2	7
Administrative	3	13	-1	+1	2	14
Operations	6 (1)	4			6 (1)	4
Safety	2	1			2	1
Maintenance	6 (3)	175	-2	-70	6 (3)	105
Int Services	0	26		-9	0	17
AIMD	0	28			0	28
Maintenance	9	175	-2	-70	7	105
General	2	0	-1		4	15
Maintenance Control	(1)	7		- 4		
Admin		1				
Quality Control	1	8		- 2		
Mtl Control		6		- 2		
Data Analysis		1				
A/C OMNT Ac	1	1		- 1	2	45
Power Plant		13		+ 5		
A/F Branch w/c	1	18		- 8		
Corros Control		9		- 6		
Avtr Equip Maint		4				
Safety Equipment		7		- 3		
Planned Maint		2		- 1		
A/C OMNT Ar/Arm	1	1			1	50
Elec Branch		11		- 5		
Fire Control		14		- 7		
Electric/Instruments		12		- 7		
Arm Branch	(1)	26	-1	-13		
Line Division	(1)	1		- 1		
Plane Captains		27		-12		
Troubleshooter		6		- 3		
AIMD						28
Power Plant Repair		4				
Electric/Inst Repair		5		+ 1		
Hydraulic Repair		1				
Airframe Repair		2		- 1		
Armament Repair		2				
Fire Control Repair		5		+ 1		
Electrical Repair		8		- 3		
Survival Equip. Repair		1				
Precision Meas. Equip. Lab.				+ 2		

NOTE: ( ) - Non-Rated

APPENDIX B. PETROLEUM, OILS, AND LUBRICANTS ANALYSIS

B.1 Cost Estimating Relationship.

F/A-X POL requirements analysis was based upon the following Cost Estimating Relationship (CER):

$$\text{Gal/FH} = -1.7812 + .007228\ (\text{Empty Weight}) + 367.966\ (\text{number of engines}) + .325\ (\text{maximum velocity})$$

where empty weight is in pounds and maximum velocity is in knots.

B.1.1 Estimate for F/A-X.

$$\text{Gal/FH} = -1.7812 + (.007228 \times 18000) + (367.966 \times 2) + (.325 \times 1400)$$
$$\text{Gal/FH} = 1.7912 + 130.1 + 735.0 + 455$$
$$\text{Gal/FH} = 1319$$

where empty weight = 18000 lbs
No of engines = 2
Max speed = 1400 knots

B.1.2 Derivation. The CER was developed by multiple regression analysis based on empty weight numbers of engines and maximum velocity. Also considered, but excluded, were maximum thrust per engine, specific fuel consumption and total thrust at cruise altitude. Table B.1 lists the data used in the regression. A 30% reduction in fuel consumption was applied to the turbo jet fuel consumption to account for the F/A-X turbofan jet technology. Figure B.1 is a scatter plot of observed versus predicted values for the aircraft in the data base. The optimum condition would be for all points to be on the 45° line.

B.1.3 Coefficient. Multiple regression correlation coefficient = .97.

TABLE B.1 DATA FOR POL CER

Acft	Empty wt	No eng	Max vel	Actual Gal/FH	Predicted Gal/FH
...	...	...	...	...	...
A-6E	25980	2	568	1017	1107
A-7E	18546	1	602	642	696
F-4B	28002	2	1296	1431	1358
...	...	...	...	...	...

GUIDANCE: THE FORMAT AND DEPTH OF DETAIL FOR THIS APPENDIX DEPEND ON THE ISSUE INVOLVED AND THE AMOUNT OF DATA AVAILABLE.

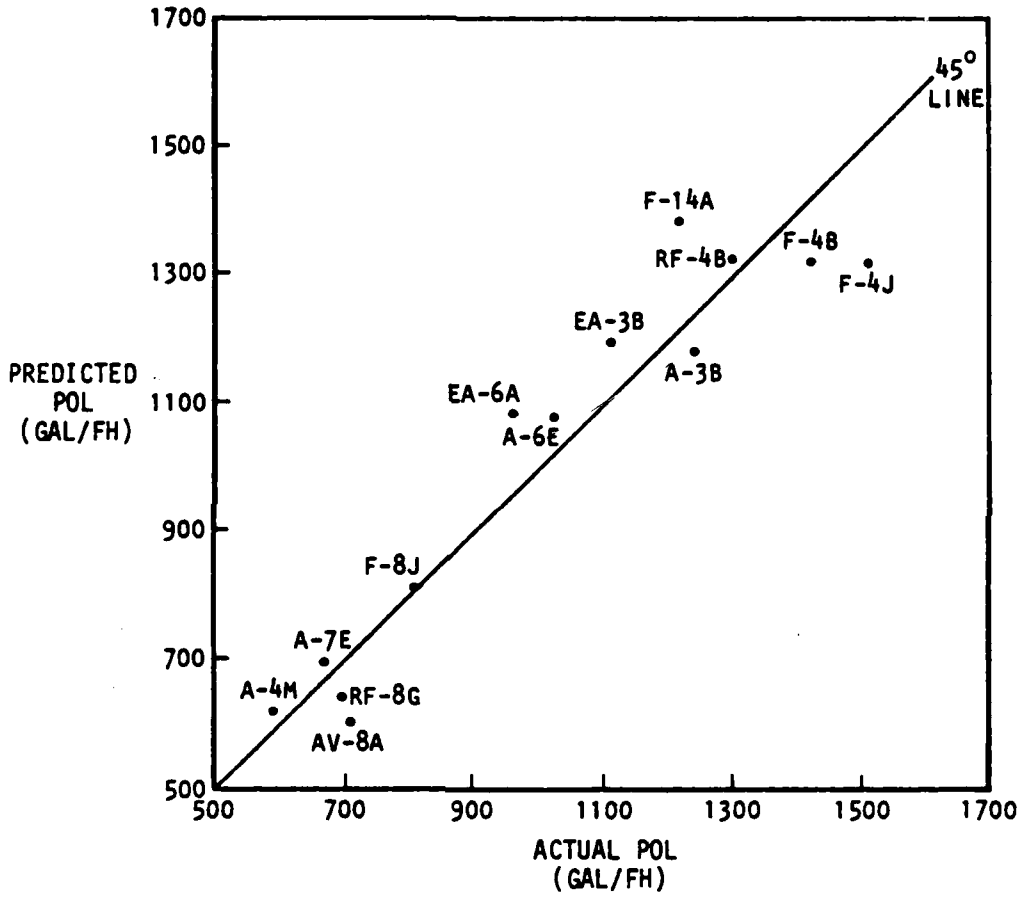

Figure B.1. POL SCATTER PLOT

APPENDIX C. COST ESTIMATING RELATIONSHIP: AIRFRAME REWORK

GUIDANCE: EXPLAIN EACH CER USED IN SUFFICIENT DETAIL SO THAT, IF NECESSARY, THE CER CAN BE VERIFIED. SEE APPENDIX B PARAGRAPH B.1

APPENDIX D.

MATHEMATICAL COMPUTATIONS

GUIDANCE: MATHEMATICAL COMPUTATIONS AND FORMULAS/ALGORITHMS LISTED IN APPENDIX D SHOULD NOT BE DUPLICATED IN APPENDIX E. NORMALLY, WHEN APPENDIX D IS USED APPENDIX E IS OMITTED.

A-7E BASELINE

UNIT MISSION PERSONNEL

Aircrew
Aircrew x rate = off costs
19 x $27,000 = $513K/sq/yr
$42.8K/acft/yr

Maintenance
Maint off x rate = Maint off costs
3 x $27,000 = $81K/sq/yr
Maint enl x rate = Maint enl costs
203 x $11,500 = $2334K/sq/yr
Maint off + Maint enl = Tot. Maint Costs
$81 + $2334 = $2415K/sq/yr
$201.3K/acft/yr

Other Unit Personnel
off x rate = off costs
1 x $27,000 = $27K/sq/yr
enl x rate = enl costs
51 x $11,500 = $587K/sq/yr
off + enl = total costs
$27 + $587 = $614K/sq/yr
$51.2K/acft/yr

UNIT LEVEL CONSUMPTION

POL
Consumption rate x POL costs
x Flying hours = sq costs
623.9 Gal/hr x $0.50 per gal = $311.95/FH
$311.95 x 372FH = $116.0K/acft/yr
$116K x 12 acft = $1392K/sq/yr

F/A-X

Aircrew
Aircrew x rate = off costs
18 x $27,000 = $486K/sq/yr
$40.5K/acft/yr

Maint off x rate = Maint off costs
1 x $27,000 = $27K/sq/yr
Maint enl x rate = Maint enl costs
133 x $11,500 = $1530K/sq/yr
Maint off + Maint enl = Tot. Maint
$27 + $1530 = $1557K/sq/yr
$129.8K/acft/yr

off x rate = off costs
1 x $27,000 = $27K/sq/yr
enl x rate = enl costs
43 x $11,500 = $494K/sq/yr
off + enl = total costs
$27 + $494K = $521K/sq/yr
$43.4K/acft/yr

CER (See appendix B)
Gal/FH= -1.7812 + (.007228 x 18,000)
+ (367.966 x 2) + (.325 x 1400)
Gal/FH = 1319
Consumption rate x POL costs
x Flying hours = sq costs
1319 gal/FH x $0.50 per gal = $659.50/FH
$659,50 x 372FH = $245.3K/acft/yr
$245.3K x 12 acft = $2944K/sq/yr

* Annual Flying Hours Program
31FH/mo/acft x 12 mo = 372FH/acft/yr
372FH x 12 acft = 4464FH/sqdn/yr

Maintenance Material: A-7E BASELINE

WUC	ELEMENT	O LEVEL	I LEVEL	TOTAL	$/FH
11, 12, 13	Structural Elem	2926	296	3222	21.45
23,27,29	Power Plant & Instal.	218	242	460	3.06
14,45,46	Fuel System Hydraulic, Pneumatic	854	302	1156	7.70
42, 44	Electrical & Wiring	767	58	852	5.49
41,47,49 91,96,97	Misc	455	81	536	3.57
51,56,57	Instruments	290	337	627	4.17
63,64,65, 66,67,71,72	Comm.Nav.Ident.	720	470	1190	7.92
73,74,75, 76,77	Offensive/ Defensive	916	1791	2707	18.02
Total		7146	3577	10723	71.40
Per Flying Hour		$47.58	$23.82		
Pre-Expensed				5089	$33.88
Personnel Support				6922	$46.08
Grand Total					$151.36

$151.36/FH x 372FH = $56.3K/acft/yr
$56.3K x 12 acft = $676K/sq/yr

Maintenance Material: F/A-X

a. Percent of DMMH/FH Not subject to change
   1. Scheduled O level - 4.9 DMMH/FH
   2. Total O level - 23.8 DMMH/FH
   3. Percent - 21%

b. O level Consumption

   1. Scheduled
      21% x baseline x Material Cost scalar
      21% x $47.58/FH x 2 = $19.98/FH

   2. Unscheduled
      79% x baseline = 79% x $47.58 = $37.58/FH
      $37.58 x Alternative System DMMH/FH ÷ Baseline DMMH/FH
      $37.58 x 12.3 DMMH/FH ÷ 18.9 DMMH/FH = $24.59/FH
      $24.59/FH x Material Cost scalar = $24.59 x 2 = $49.18/FH

   3. Total
      $19.98 + $49.18 = $69.19/FH

c. I level Consumption (5.4 DMMH/FH)
   Baseline x Material Cost scalar
   $23.82 x 2 = $47.64/FH

d. Pre expensed
   Baseline (Proposed DMMH/FH ÷ Baseline DMMH/FH)
   $33.88 (4.9 + 12.3 + 5.4) ÷ 29.2 = $26.22/FH

e. Personnel Support
   Baseline (Proposed SQML ÷ Baseline SQML) =
   $46.08 (196 ÷ 277 = $32.61 F/H

f. Total $69.19 + 47.64 + 26.22 + 32.61 = $175.63/FH
   $175.63 x 372FH = $65.3K/acft/yr
   $65.3K x 12 acft = $784K/sq/yr

A-7E BASELINE F/A-X

Training Ordnance
Reported Costs x Escalation Factor =
Baseline Costs
$5,852K(FY78) x 1.1555 - $6763K(FY80)
Total Costs ÷ no of Sqdns = Cost/Sqdn
$6763K÷ 28 = $241K/sq/yr

Sq Cost= (F/A-X crews ÷ Baseline crews) Baseline Costs
(18 ÷ 19) $241K= $228K/sq/yr

DEPOT LEVEL MAINTENANCE

A-7E BASELINE

F/A-X

Airframe Rework

$17,176K (FY78) x 1.1555 = $19,848K (FY80)
$19,848K ÷ 154,005 hrs = $128.88/FH

$128.88 x 372FH = $47.9K/acft/yr
$47.9K x 12 acft = $575K/sq/yr

CER (See appendix C)
SDLM in 76$ = -$38,597 + 8.0406 (Empty Weight) + 25.842 (Max Velocity)
= -$38,597 + 8.0406 (18,000) + 25.842 (1400)
= $142,312

$142,312 (FY76) x 1.4066 = $200,180 (FY80)
Cost per SDLM - $200,180
$200,180 ÷ 84 mo SDLM interval x 12 mo = 28.6K/acft/yr
$28.6 x 12 acft = $343K/sq/yr
Note: If 48 mo interval is assumed, cost becomes $600.K/sq/yr

Engine Rework

$233/FH (FY79) x 1.0690 = $249.08 (FY80)
$249.08/FH x 372FH = 92.7K/acft/yr
$92.7K x 12 acft = $1112K/sq/yr

Sq costs = Eng reliability, A-7E ÷ Eng reliability F/A-X x A-7E costs
(25.5 ÷ 12.8) $92.7K = $184.7K/acft/yr
$184.7K x 12 acft = $2224K/sq/yr

Component Rework: A-7E BASELINE

WUC	ELEMENT	LABOR	MAT	TOTAL	$/FH
11,12,13	Structural Elm.	1651	550	2201	$14.65
23,27,29	Power Plant & Install	1503	239	1742	11.59
24,45,46	Fuel System, Hydraulic, Pneumatic Controls	767	994	1761	11.72
42,44	Electrical & Wiring	417	196	613	4.08
41,47,49 91,96,97	Misc	970	1260	2230	14.84
51,56,57	Instruments	2089	655	2744	18.27
63,64,65 66,67,69 71,72	Comm.Nav.Ident.	1193	283	1476	9.83
73,74,75, 76,77	Offensive/ Defensive	6232	1984	8216	54.70
Total		14822	6161	20983	$139.70

$139.70 x 372FH = $52.0K/acft/yr
$52K x 12 acft = $624K/sq/yr

Component Rework: F/A-X

1. Structural Element
   a. Labor
      (1.) Baseline x Percent design controlled
           x (Reliability, Baseline ÷ Reliability F/A-X)

           $1651 x .78 x (5.3 ÷ 7.5) = $907

      (2.) Baseline x Percent environment controlled
           1651 x .22 = 363
           Total labor = $907 + $363 = $1270

   b. Material Costs
      (1.) 550 x .78 x ($\bar{R}$ Baseline ÷ $\bar{R}$ Proposed) x Material Cost scalar
           550 x .78 x (5.3 ÷ 7.5) x 2 = $604
      (2.) 550 x .22 x 2 = $242
           Total Material = $846

   c. Total Costs = Labor + Material = $2,116

   d. Sqdn Costs
      $2,116 ÷ 150,192 FH = $14.09/FH

2. Power Plant & Installation
   a. Labor
      (1.) $1,501 x (25.5 ÷ 12.8) = $2994

   b. Material Costs
      (2.) $239 x (25.5 ÷ 12.8) = $476

   c. Total Costs = $2,994 + $476 = $3,470

   d. Sqdn Costs
      $3,470 ÷ 150,192 FH = $23.10/FH

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8. Offensive/Defensive

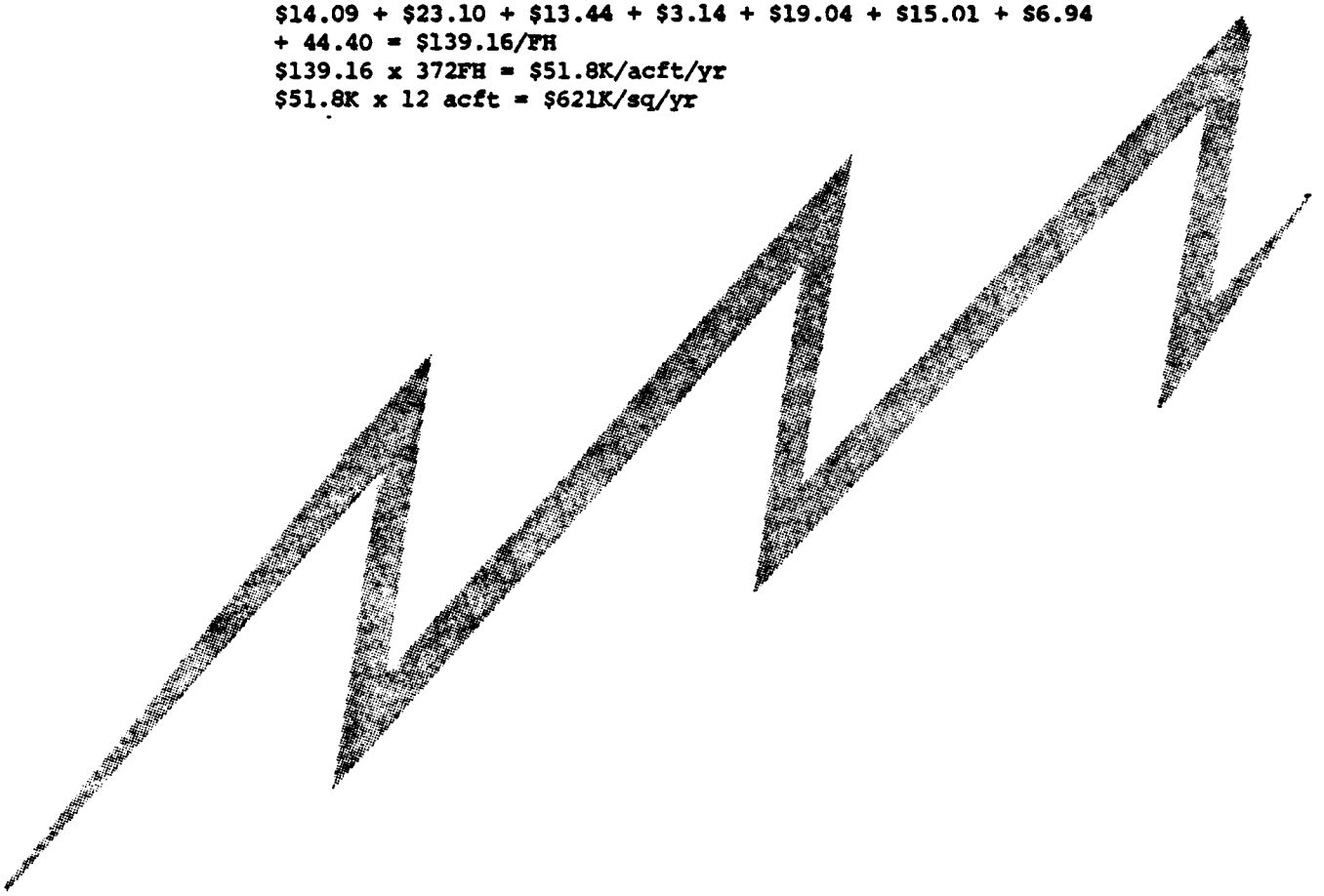
   a. Labor
      (1.) $6232 x .63 x (4.7 ÷ 10.5) = $1769
      (2.) 6232 x .37 = 2306
           Total Labor $4075

   b. Material
      (1.) $1984 x .63 x (4.7 ÷ 10.5) x 2 = $1126
      (2.) 1984 x .37 x 2 = 1468
           Total Material $2594

c. Total Costs = $4,075 + $2,594 = $6,669

d. Sqdn Costs
$6,669 ÷ 150,192FH = $44.40/FH

9. Total Component Rework
$14.09 + $23.10 + $13.44 + $3.14 + $19.04 + $15.01 + $6.94 + 44.40 = $139.16/FH
$139.16 x 372FH = $51.8K/acft/yr
$51.8K x 12 acft = $621K/sq/yr



A-7E BASELINE	F/A-X
Support Equipment Repair	
(See replacement, Support Equipment)	(See replacement, Support Equipment)
Replacement costs x repair factor x sq acft = sq costs $15K x 4.2% = $.63K/acft/yr $.63K x 12 acft - $8K/sq/yr	Replacement costs x repair factor x sq acft = sq costs $22 x 4.2% = $.92K/acft/yr $.92K x 12 acft - 11K/sq/yr
Software	
Not applicable	Undetermined at this time
Modification	
See Modification Kits	See Modification Kits
Other Depot	
$16,177 (FY78) x 1.1555 = $18,694 (FY80) 18,694K ÷ 154,005 hrs = $121.38/FH 121.38 x 372FH = $45.2K/acft/yr $45.2K x 12 acft = $542K/sq/yr	Baseline Costs x Alternative system depot costs ÷ Baseline system depot costs $45.2K ($3188 ÷ $2311) = $62.4K/acft/yr $62.4K x 12 acft = $748K/sq/yr
Contracted Unit Level Support	
Not applicable	Undetermined at this time

SUSTAINING INVESTMENT

Reparable Spares: A-7E BASELINE

WUC	ELEMENT	I LEVEL COND.	DEPOT COND.	TOTAL	$/FH
11,12,13	Structural	752	749	1501	$9.99
23,27,29	Power Plant & Inst.	16	356	372	2.48
14,45,46	Fuel System Hydraulic Pneu-matic Control	580	419	999	6.65
42,44	Electrical & Wiring	84	47	131	0.87
41,47,49 91,96,97	Misc	178	238	416	2.77
51,56,57	Instruments	117	224	341	2.27
63,64,65, 66,67,69,71,72	Comm, Nav. Ident	40	105	145	0.97
73,74,75,76,77	Offensive/ Defensive	461	617	1078	7.17
	Total	2228	2755	4983	$33.17

$33.17 x 372FH = $12.3K/acft/yr
$12.3K x 12 acft = $148K/sq/yr

Reparable Spares: F/A-X

1. Structural Element

Baseline Costs x design control % x (Reliability, Baseline ÷ Reliability, F/A-X) x Material Cost Scalar = costs/FH
$9.99 x 78% x (5.3 ÷ 7.5) x 2 = $11.01/FH

Baseline Costs x environment control % x Material Cost scalar = cost/FH
$9.99 x 22% x 2 = $4.40
design controled costs + environment controled cost = total costs
$11.01 + $4.40 = $15.51/FH

2. Power Plant & Installation
Baseline costs x (Reliability, Baseline ÷ Reliability, F/A-X) = cost/FH
$2.48 x (25.5 ÷ 12.8) = $4.94/FH

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8. Offensive/Defensive
Baseline costs x design control % x (Reliability, Baseline ÷ Reliability F/A-X) x Material Cost scalar = costs/FH
$7.17 x 63% x (4.7 ÷ 10.5) x 2 = $4.04
Baseline costs x environment control % x Material Cost scalar = costs/FH
$7.17 x 37% x 2 = $5.31/FH
design control costs + environment control costs = total costs
$4.04/FH + $5.31/FH = $9.34/FH

9. System Costs
$15.41 + $4.94 + $9.81 + $1.14 + $4.53 + $3.02 + $1.12 + $9.34 = $49.32/FH
$49.32/FH x 372FH = $18.3K/acft/yr
$18.3K x 12 acft = $220K/sq/yr

A-7E BASELINE	F/A-X
Replacement Support Equipment	
Spt Equip = Flyaway costs x replacement factor $6.71M x .218% = $14.6K/acft/yr $14.6K x 12 acft = $175/sq/yr	Spt Equip = Flyaway costs x replacement factor $10M x .218% = $21.8K/acft/yr $21.8K x 12 acft = $264/sq/yr
Modification Kits*	
$7515 (78) = $8684 (80) $8684K ÷ 154,005FH = $56.38/FH $56.39 x 372FH = $21K/acft/yr $21K x 12 acft = $252K/sq/yr	Undetermined at this time. Baseline figures are used to avoid distortion of the comparison
*Includes engineering and initial support	
Other Recurring Investment	
Not applicable	Not applicable

A-7E BASELINE	F/A-X

INSTALLATION SUPPORT PERSONNEL

BOS

$11/acft (79) = $11.7K(80)/acft/yr

11.7K x12 acft = $140K/sq/yr

Alternative = Baseline (Proposed SQML ÷ Baseline SQML)
= $11.7K x (20 + 176) ÷ (23 + 2
= $11.7K x .70758
= $8.3K/acft/yr
= $8.3 x 12 acft = $99K/sq/yr

Real Property Management

Included in BOS

Included in BOS

Medical

$.21K(officers) + .41K(enlisted = $.62K total
$.62K (79) = $.66K (80)/acft/yr
$.66K x 12 acft = $8K/sqdn/yr

Alternative = Baseline (Proposed SQML ÷ Baseline SQML)
= $.66K x .70758 = $.47K/acft/yr
= $.47 x 12 acft = $6K/sq/yr
=

INDIRECT PERSONNEL SUPPORT

Miscellaneous Operations & Maintenance

Cannot be determined at this time

Cannot be determined at this time

Medical O&M (Non-Pay)

$9/acft (79) = $9.6K/acft/yr (80)

$9.6K x 12 acft = $115K/sqdn/yr

Alternative = Baseline (Proposed SQML ÷ Baseline SQML)
= $.6K x .70758 = $6.8K/acft/yr
= $6.8K x 12 acft = $82K/sq/yr
=

PCS

$12/acft (79) = $12.8K(80)/acft/yr

12.8 x 12 acft = $154K/sqdn/yr

Alternative = Baseline (Proposed SQML ÷ Baseline SQML
= $12.8K x .70758 = $9.0K/acft/y
= $9K x 12 acft = $109K/sq/yr

Temp Additional Duty Pay

$511 (78) = $590.9K(80)

590.9K ÷ 261 acft = $2.3K/acft/yr
$2.3K x 12 acft = $27K/sq/yr

Alternative = Baseline (Proposed enlisted pop. ÷ Baseline Enlisted pop.)
= $2.3K x .69291 = $1.6K/acft/yr
= $1.6K x 12 acft = $19K/sq/yr

A-7E BASELINE	F/A-X

DEPOT NON-MAINTENANCE

General Depot

$2383 (78) = $2753.7 (80)	Alternative = Baseline (Proposed Depot Maint & Sustaining Investment + Baseline Depot Maint & Sustaining Investment)
2753.7 ÷ 154,005FH = $17.88/FH $17.88 x 372FH = $6.7K/acft/yr $6.7K x 12 acft - $80K/sq/yr	$6.7K (4804.9 ÷ 3516.1) = $9.1K/acft/yr $9.1K x 12 acft = $109K/sq/yr

Second Destination Transportation

Cannot be determined at this time	Cannot be determined at this time

PERSONNEL ACQUISITION & TRAINING

Acquisition

$1 (79) = $1.2K (80)/acft/yr	Alternative = Baseline (Proposed SQML + Baseline SQML)
$1.2K x 12 acft = $14K/sqdn/yr	$1.2K x .70758 = $.85K. acft/yr $.85K x 12 acft = $9K/sq/yr

Individual Training

$7K (79) = $7.5K (80)/acft/yr	Alternative = Baseline (Proposed SQML + Baseline SQML)
$7.5K x 12 acft = $90K/sqdn/yr	$7.5K x .70758 = $5.3K/acft/yr $5.3K x 12 acft = $64K/sq/yr

APPENDIX E. O&S COST ESTIMATING MODEL

E.1 General.

For this analysis the Navy . . . model was used . . . . This model is a deterministic mathematical model which is preprogrammed and completely structured . . . .

E.2 Use & Application.

This model has been in use since . . . calculates annual squadron operating costs . . . .

E.3 Model Logic.

Table E-1 lists the algorithms used in the model logic . . . .

E.4 Results.

Tables E.2.A through E.2.( ) are the computer products identifying both input values and results for each alternative . . . .

GUIDANCE: WHEN APPENDIX E IS USED APPENDIX D WILL BE OMITTED. THE FORMAT USED AND THE INFORMATION PROVIDED IN APPENDIX E DEPEND ON THE COMPUTER MODEL USED.

TABLE E.1. O&S COST ESTIMATING MODEL ALGORITHMS

UNIT MISSION PERSONNEL

Aircrew
A = Aircrew (officer) x Officer Pay
B = Aircrew (Enlisted) x Enlisted Pay

Maintenance
C = Maint (Offciers) (less air crew) x Officer Pay
D = Maint (Enlisted) x Enlisted Pay.

Other Personnel
E = Other Officers x Officer Pay
F = Enlisted x Enlisted Pay

UNIT LEVEL CONSUMPTION

POL
G = Consumption Rate x POL unit costs x flying Hours per air craft x PAA acft/sqdn x K factor

Maintenance Material
H = O Level cost x . . . .
I = I Level cost x . . . .

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PERSONNEL ACQUISITION & TRAINING

Acquisition
EE = Recruiting Cost factor x Sqdn Personnel x Turnover Rate x K factor

Individual Training
GG = Specialty Training Cost x Sqdn Personnel x Annual Rate x K factor

GUIDANCE: WHEN FACTORS ARE USED, INSURE THAT THE EQUATION FROM WHICH THE FACTOR IS DERIVED IS INCLUDED.

TABLE E.2.A. ANNUAL SQUADRON OPERATION AND SUPPORT COST ANALYSIS

MODEL:
TIME: 1719.0 Fri 02/08/80 COMPUTER PROGRAM:
DATA FILE:

GENERAL

PAA/SQ ....12 FH/PAA/YR - PEACE .. 31
CREWS/PAA.........1.5 WAR .... N/A

INPUT VALUES	OFFICER	ENLISTED	CIVILIAN	TOTAL
No of Aircrew	18	0	0	18
No of Maintenance Pers	1	133	0	134
Other Pers	1	43	0	44

POL costs - $0.50/gal

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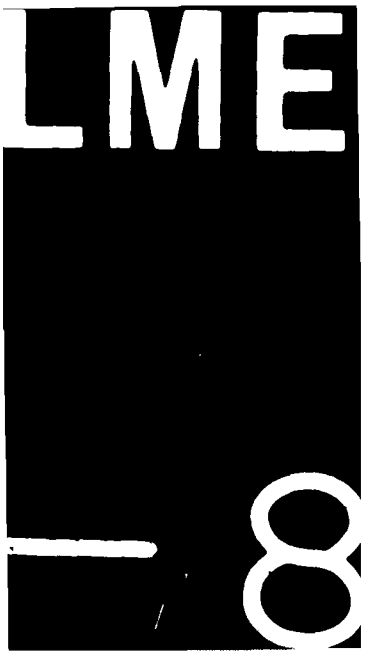
Acquisition K factor - ...
Individual Training K factor - ...

TABLE E.2.A. (CONTINUED) ANNUAL SQUADRON OPERATION AND SUPPORT ANALYSIS

TIME: 1719.0 Fri 02/08.80 DATA FILE:

RUN RESULTS:

Unit Mission Personnel		$2564
Air Crew	486	
Maintenance	1557	
Other	521	
Unit Level Consumption		$3956
POL	2944	
Maintenance Material	784	
Training Ordnance	228	
Depot Level Maintenance		$3947
Airframe Rework	343	
Engine Rework	2224	
Component Repair	621	
Support Equipment	11	
Software	-	
Modifications	-	
Other Depot	748	
Contract Unit Level Support	-	
Sustaining Investment		$ 736
Reparable Spares	220	
Replacement Support Equip.	264	
Modification Kits	252	
Other Recurring Investment	-	
Installation Support Personnel		$ 105
Base Operating Support	99	
Real Property Management	-	
Medical	6	
Indirect Personnel Support		$ 209
Misc Operations & Maint.	-	
Medical O&M Non-Pay	82	
Permanent Change of Station	108	
Temporary Additional Duty Pay	19	
Depot Non-Maintenance		$ 109
General Depot Support	109	
Second Dest Transportation	-	
Personnel Acquisition & Training		$ 73
Acquisition	9	
Individual Training	64	
TOTAL		$11699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